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Ceratosporium hainanense and *Solicorynespora obovoidea* spp. nov., and a first record of *Bactrodesmiastrum obscurum* from southern China

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Abstract — Two new anamorphic fungi, *Ceratosporium hainanense* sp. nov. and *Solicorynespora obovoidea* sp. nov., were collected on dead branches in tropical forest of southern China. They are described, illustrated, and compared with similar taxa. *Bactrodesmiastrum obscurum* is recorded for the first time from China. A key to *Ceratosporium* species is provided.

Key words — anamorphic fungi, taxonomy

Introduction

Our surveys of conidial fungi occurring on dead branches in the forest ecosystems of southern China have yielded three new genera (Ren et al. 2012, Zhang et al. 2012), and several new species and records for China (e.g. Zhang et al. 2008, 2009, 2011; Ma et al. 2011, 2012a,b). During continuing exploration for saprobic microfungi in these forests, three hyphomycetes of the genera *Ceratosporium* Schwein., *Solicorynespora* R.F. Castañeda & W.B. Kendr., and *Bactrodesmiastrum* Hol.-Jech. were collected on dead branches. *Ceratosporium hainanense* and *Solicorynespora obovoidea* are described here as new species, and *Bactrodesmiastrum obscurum* represents a new record from China.

Ceratosporium hainanense Jian Ma & X.G. Zhang, **sp. nov.** Fig. 1

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Differs from *Ceratosporium gracile* and *C. indicum* by its smooth conidia with a conspicuous pyriform basal cell and more arms, which are shorter and contain fewer

Fig. 1. *Ceratosporium hainanense* (holotype). Conidiophores and conidia.

septa and from *C. caribense* by its conidia with a conspicuous pyriform basal cell and fewer arms.

Type: China, Hainan Province: Lingao, on dead branches of unidentified broad-leaved tree, 9 Dec. 2010, J. Ma (**Holotype**, HSAUP H5488; **isotype**, HMAS 243445).

Etymology: refers to the province where the type was found.

Colonies effuse, dark brown. Mycelium superficial and immersed, composed of branched, septate, pale brown to brown, smooth-walled hyphae. Conidiophores undifferentiated, smooth, brown, 4–6.5 μm long, 2.5–3.5 μm wide, scattered on the superficial mycelium. Conidiogenous cells integrated, intercalary, monoblastic, determinate, cylindrical, denticulate. Conidia solitary, basal cell single, pyriform, brown, smooth, with an obvious scar, 3–4 μm wide; 3–5 arms arising from the apex, arms united and closely adpressed at the base, distal ends of arms straight or flexuous and divergent, brown, pale brown toward the apex, smooth, arms 6–14-septate, not constricted at the septa, 75–140 μm long (most of unequal length), 5.5–7.5 μm wide at the base and tapering to 2–3 μm wide at the apex.

Comments – Schweinitz (1832) established *Ceratosporium* with *C. fuscescens* Schwein. as type species. Subsequently, Hughes (1951) gave a detailed account of conidial development and the taxonomy of *Ceratosporium* species. Hughes (1964) re-described *C. fuscescens* and *C. rilstonei* S. Hughes from New Zealand collections, drawing attention to the occurrence of secondary conidial fructifications. The genus is characterized by inconspicuous flexuous

brown conidiophores and integrated intercalary monoblastic determinate denticulate conidiogenous cells that produce solitary conidia with a central cell and divergent pluriseptate branches (Ellis 1971). Ten species are currently accepted in *Ceratosporium* (Kirschner & Chen 2004), of which six produce smooth conidia and four produce verrucose conidia. Only four species have been previously recorded from China (Zhao et al. 2010).

Ceratosporium hainanense is closely related to *C. gracile* Matsush., *C. indicum* V.G. Rao & D. Rao, and *C. caribense* Hol.-Jech. in conidial shape. However, *C. gracile* and *C. indicum* differ from *C. hainanense* by their verrucose conidia without a pyriform basal cell and with arms that are fewer, longer, and more septate (Matsushima 1981, Rao & Rao 1970); *C. caribense* differs by its conidia without a pyriform basal cell and with more and shorter arms (Holubová-Jechová 1988).

Key to species of *Ceratosporium*

1. Conidia V- or Y-shaped, each of the 2 divergent branches arising from conidial apex **2**

1. Conidia with 2–3 or more arms united at base, distal ends of arms divergent **3**

2. Conidia V-shaped, verrucose, lateral arms subulate, 12–24 µm long, 3.5–4.5 µm wide at the base, 1–3-septate ..... ***C. aequatoriale***

2. Conidia Y-shaped, smooth, lateral arms subulate, 20–90 µm long, 5.5–10 µm wide at base, 1–9-septate ..... ***C. cornutum***

3. Conidia with 2–5 arms that are 20–32 × 4–6 µm, 6–10-septate ..... ***C. palmiforme***

3. Conidia with 2–3(–4), 3–5, or 5–6 arms that are ≥34 µm long, >7 µm wide at base ... **4**

4. Conidia smooth **5**

4. Conidia verrucose **9**

5. Arms of conidia united and closely adpressed at base, sometimes coiled around each other **6**

5. Arms of conidia united, not closely adpressed or intertwined at base **8**

6. Conidia with 3–5 arms that are75–140 µm long, 5.5–7.5 µm wide at base, 2–3 µm wide at apex, 6–14-septate ..... ***C. hainanense***

6. Conidia with 2–3 or 5–6 arms that are >180 µm long, ≥8 µm wide at base, (5–)6–8 µm wide at apex **7**

7. Conidia with 5–6 arms that are 90–340 µm long, 8–16 µm wide at base, 5–8 µm wide at apex, 9–15-septate ..... ***C. caribense***

7. Conidia with 2–3 arms that are 130–190 µm long, 14–17 µm wide at base, 6–8 µm wide at apex, 8–14-septate ..... ***C. rilstonei***

8. Conidia with 2–4 arms that are 90–180 µm long, 11–15 µm wide at base, 3.5–5.5 µm wide at apex, 10–14-septate ..... ***C. productum***

8. Conidia with 2–3 arms that are 120–210 µm long, 14–22 µm wide at base, 5–10 µm wide at apex, 11–17-septate ..... ***C. fuscescens***

9. Conidia with 2–3 arms that are34–56 µm long, 12–14 µm wide at base, 7–11-septate ..... ***C. verrucosum***

9. Conidial arms >180 µm long, ≤10 µm wide at base, ≤23–24 septate **10**

10. Conidia with 2–3 arms, that are 36–192 µm long, 6–10 µm wide at base, 2.5–3.5 µm wide at apex, 5–24-septate ..... ***C. gracile***

10. Conidia with 2–3 arms that are140–378 µm long, 3.6–7.2 µm wide at base, up to 3.6 µm wide at apex, 14–23-septate ..... ***C. indicum***

Solicorynespora obovoidea Jian Ma & X.G. Zhang, **sp. nov.** Fig. 2

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Differs from all other *Solicorynespora* species by its obovoid conidia with septa usually obscured by a band of pigment.

Type: China, Guangdong Province: Liuxihe National Forest Park, on dead branches of unidentified broad-leaved tree, 18 Oct. 2010, J. Ma (**Holotype**, HSAUP H5513; **isotype**, HMAS 243446).

Etymology: refers to the obovoid conidial shape.

Colonies on natural substrate effuse, brown to dark brown, hairy. Mycelium superficial and immersed, composed of hyphae that are branched, septate, pale brown to brown, smooth-walled. Conidiophores distinct, single, solitary or in groups, erect, straight or flexuous, unbranched, smooth, septate, brown to dark brown, 80–115 µm long, 4.5–7 µm wide, sometimes with 1 lageniform percurrent extension. Conidiogenous cells monotretic, integrated, terminal, cylindrical or lageniform, pale brown to brown, smooth, 11–16 µm long, 3.5–4.5 µm wide. Conidia solitary, dry, acrogenous, obovoid, apex rounded, base truncate, 2-euseptate, the septa usually obscured by a dark band, smooth, brown to dark brown, basal cell paler; 16–22 µm long, 9–11 µm wide in the widest part, 1.5–2.5 µm wide at the base. Conidial secession schizolytic.

Comments – Castañeda Ruíz & Kendrick (1990) established *Solicorynespora* with *S. zapatensis* R.F. Castañeda & W.B. Kendr. as type species. *Solicorynespora* is characterized by solitary brown to dark brown euseptate phragmoconidia that are produced from integrated terminal monotretic conidiogenous cells. The conidiophores are distinct and determinate or percurrently extending one or more times. Siqueira et al. (2008) summarized the essential characteristics of *Solicorynespora* and similar genera including *Corynespora* Güssow, *Corynesporella* Munjal & H.S. Gill, *Hemicorynespora* M.B. Ellis, *Corynesporopsis* P.M. Kirk, and *Corynesporina* Subram. and discussed the distinguishing characters of these genera.

The twenty-one species accepted in *Solicorynespora* are distinguished primarily on conidial features including shape, size, septation, ornamentation, pigmentation, and presence or absence of an appendage (Castañeda Ruíz 1996, Castañeda Ruíz et al. 2004, Ma et al. 2012b,c). Keys to *Solicorynespora*

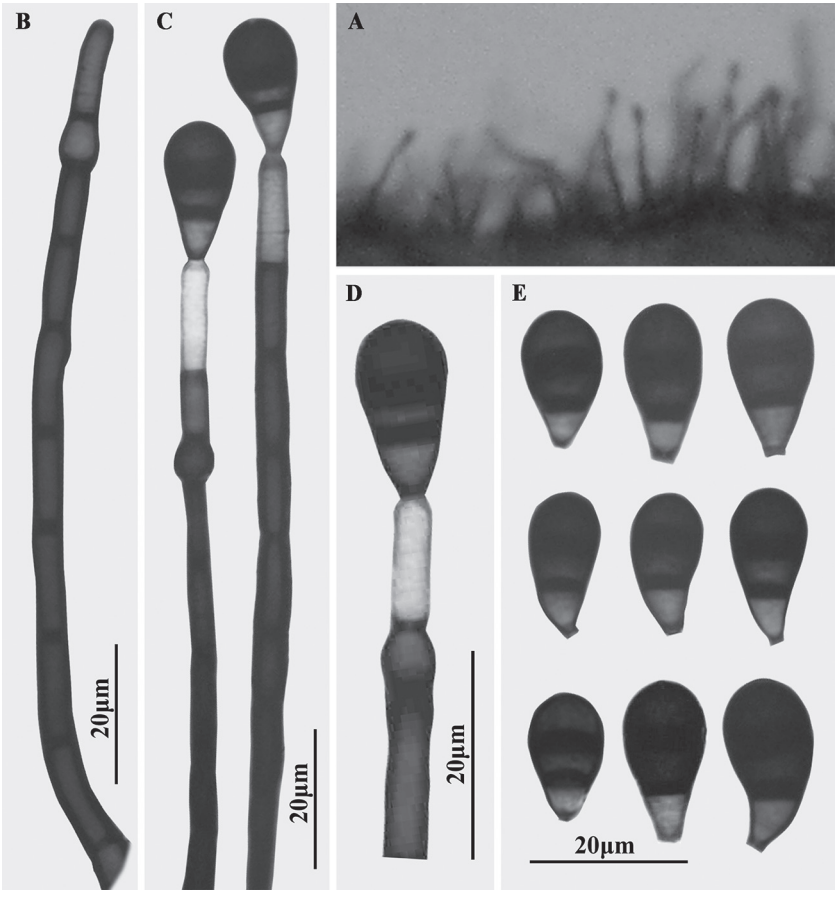

Fig. 2. *Solicorynespora obovoidea* (holotype). A. Colonies on natural substratum. B. Conidiophore. C–D. Conidiophores and conidia. Conidiophore apices showing conidiogenous cells and percurrent extension. E. Conidia.

species have been given by Castañeda Ruíz et al. (2004), Ma et al. (2012c), and Hernández-Restrepo et al. (2014) based mainly on conidial morphology. In addition, Ma et al. (2012c) provided a synoptic table of the main morphological features that distinguish 15 accepted *Solicorynespora* species. Hernández-Restrepo et al. (2014) illustrated representative conidia of 21 species and revealed the high affinity of *Solicorynespora insolita* Hern.-Restr. et al. with the family *Kirschsteiniotheliaceae* and a particularly close affinity with *Astrosphaeriella livistonicola* K.D. Hyde & J. Fröhl. based on the 28S rDNA D1/D2 sequence. Teleomorphs and phylogenetic affinities of other *Solicorynespora* species based on molecular sequence analyses are not yet known.

Solicorynespora obovoidea bears some resemblance to three other species with 2-septate conidia: *S. biseptata* Silvera et al., *S. calophylli* (Hol.-Jech. & R.F. Castañeda) R.F. Castañeda & W.B. Kendr., and *S. lasianthi* L.G. Ma & X.G. Zhang. However, *S. biseptata* differs by its slightly smaller obclavate conidia with the dark brown basal and middle cells and the pale brown apical cell (Hernández-Restrepo et al. 2014); *S. calophylli* differs by its smaller obclaviform to obpyriform conidia, strongly constricted at the septa, with the verrucose brown basal and middle cells and the rostrate subhyaline to hyaline apical cell (Holubová-Jechová & Castañeda Ruíz 1986, as *Corynespora calophylli*); and *S. lasianthi* differs by its smaller cylindrical to ellipsoid conidia with the pale brown basal cell and the brown middle and apical cells (Ma et al. 2012d).

Bactrodesmiastrum obscurum Hol.-Jech., Folia Geobot. Phytotax. 19(1):105, 1984. Fig. 3

Colonies on natural substratum effuse, blackish brown to black. Mycelium superficial and immersed, composed of branched, septate, pale brown, smooth-walled hyphae. Conidiophores distinct, but reduced to a single conidiogenous cell, solitary at first, later aggregated in small groups. Conidiogenous cells borne on basal hyphae, monoblastic, cylindrical or lageniform, brown to dark brown, 6.5–12 × 2–3.5 µm, 1–1.5 µm wide at the truncate apex. Conidia solitary, dry, acrogenous, straight or slightly curved, clavate to obovoid, mostly 3-septate, rarely 4-septate, smooth, dark brown to black, two proximal cells paler than others, 25–34 × 10–14 µm, basal cell conico-truncate, basal scar 1–1.5 µm wide. Conidial secession schizolytic.

Specimen examined: **CHINA**, **Hainan Province**: Jianfengling National Nature Reserve, on dead branches of unidentified broad-leaved tree, 27 April 2006, J. Ma (HSAUP VI$_0$-0041, HMAS 243447).

Comments – *Bactrodesmiastrum* was erected by Holubová-Jechová (1984) with *B. obscurum* as type species. The genus remained monotypic until Hernández-Restrepo et al. (2013) described *B. pyriforme* Hern.-Restr. et al. and *B. obovatum* (M. Calduch et al.) J. Mena et al. from decaying wood in Spain. ITS and LSU rDNA sequence analyses have confirmed the separation between *B. obovatum* and *B. pyriforme*, but sequence data are not yet known for *B. obscurum* (Hernández-Restrepo et al. 2013). *Bactrodesmiastrum* is mainly characterized by short unbranched aseptate cylindrical to conical solitary or aggregated conidiophores reduced to a single monoblastic terminal determinate conidiogenous cell and solitary clavate obovoid to pyriform multiseptate conidia with schizolytic conidial secession. *Bactrodesmiastrum* differs from the most similar genus, *Bactrodesmium* Cooke, which has sporodochial conidiomata and differentiated hyaline or brown simple or branched conidiophores bearing mono- or polyblastic conidiogenous cells (Ellis 1971, Holubová-Jechová 1972).

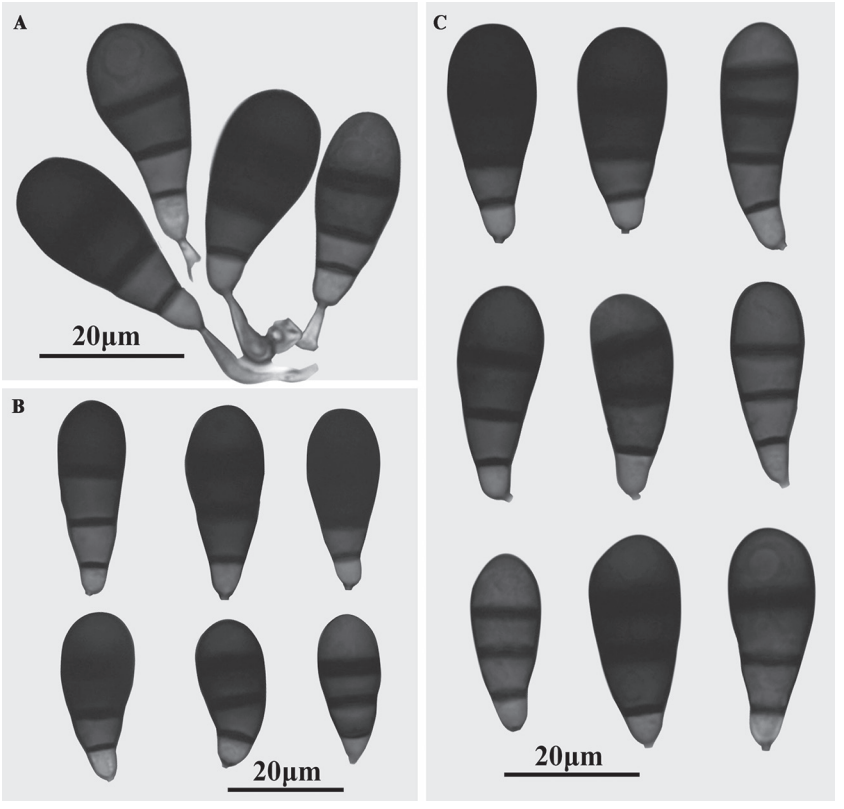

Fig. 3. *Bactrodesmiastrum obscurum*. A. Conidiogenous cells and conidia. B–C. Conidia.

Bactrodesmiastrum obscurum was found originally on decaying wood of *Fagus sylvatica* in Czechoslovakia. It is also known from Spain on dead wood and has been re-described by Hernández-Restrepo et al. (2013). Its known distribution is now extended to include China. *Bactrodesmiastrum obscurum* differs from the other two species in the genus by its clavate to obovoid conidia with two paler proximal cells. It further differs from *B. pyriforme* in its smaller conidia, and from *B. obovatum* in its conidia with predominately three septa. The Chinese collection corresponds well with the original description of *B. obscurum* except that the conidia occasionally display four septa. This fungus is reported for the first time from China.

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